

## VERIFICATION OF TRANSLATION

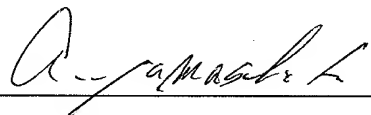
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The specification accompanying the Application No. 09-300295 for a  
Patent made in Japan filed on October 31, 1997.

April 16, 2008

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Akihiko YAMASHITA

(No witness required)

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[Title of the Invention] PATTERN-FORMING MATERIAL AND METHOD  
FOR PATTERN FORMATION

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[Title of the Invention] PATTERN-FORMING MATERIAL AND METHOD  
FOR PATTERN FORMATION

[Patent claims]

[Claim 1] A pattern-forming material adapted for optically forming a pattern, characterized by comprising a photocatalyst-containing layer provided on a substrate, and the photocatalyst-containing layer contains polysiloxane having a fluoroalkyl group.

[Claim 2] The pattern-forming material according to claim 1, characterized in that the fluoroalkyl group contains a sulfonamide group.

[Claim 3] The pattern-forming material according to claim 1 or 2, characterized in that the pattern-forming material is an original plate for a printing plate.

[Claim 4] A method for pattern formation adapted for optically forming a pattern, characterized in that a photocatalyst provided on a substrate and a pattern-forming material containing polysiloxane having a fluoroalkyl group are pattern-exposed to vary wettability of a surface of the pattern-forming material through photocatalytic action.

[Detailed description of the Invention]

[0001]

[Field of the Invention]

The present invention relates to a novel pattern-forming material which can be used for printing and other purposes, and especially to a pattern-forming material which can provide a novel original plate for a printing plate.

[0002]

[Prior Art]

In plates for lithography, i.e., a kind of printing method, printing ink-receptive lipophilic areas and printing ink-unreceptive areas are provided on a flat plate. In use, an ink image to be printed is formed on the lipophilic areas and then transferred and printed onto paper or the like.

[0003]

A large number of proposals have been made on original plates for printing plates that are used in offset printing which is representative lithography. Among them, plate for offset printing wherein the original plate for a printing plate is directly exposed by electrophotography to prepare a printing plate is widely used. The original plate for an electrophotographic offset printing plate is prepared by a method which comprises the steps of: providing a photoconductive layer composed mainly of supporting body to form a photoreceptor; exposing the photoreceptor by electrophotography to form a highly lipophilic image on the surface of the photoreceptor; and subsequently treating the photoreceptor with a desensitizing

liquid to hydrophilify nonimage areas to prepare an original plate for offset printing. Hydrophilic areas are immersed in water or the like and are consequently lipophobified, and a printing ink is received by the lipophilic image areas followed by transfer onto paper or the like.

An original plate for waterless lithography has also been used wherein, instead of the immersion in water to form lipophobic areas, highly lipophobic areas are formed without relying upon immersion in water or the like to form ink-receptive areas and ink-unreceptive areas.

[0004]

Further, a method for producing an original plate for lithography using a heat mode recording material has been proposed which can realize the formation of highly ink-receptive areas and ink-repellent areas by laser beam irradiation.

Heat mode recording materials can eliminate the need to provide the step of development and the like, and advantageously enables printing plates to be produced simply by forming an image using a laser beam. They, however, suffer from problems associated with the regulation of laser beam intensity, the disposal of residues of solid materials denatured by the laser, the plate wear and the like.

[0005]

The inventors had previously proposed a method for pattern

formation using a material of which wettability varied through photocatalytic action and a pattern-forming material in the Japanese Patent Application Laid-Open No. 9-214825 as a pattern-forming material which can solve problems mentioned above. The present invention provides a pattern-forming material having further excellent properties compare to those pattern-forming materials using photocatalysts.

[0006]

[Problems to be solved by the Invention]

It is an object of the present invention to provide a novel pattern-forming material. It is another object of the present invention to obtain a pattern-forming material which can provide a novel original plate for a printing plate that can solve the problems of the conventional original plates for printing plates.

[0007]

[Means for solving the problem]

The present invention provides a pattern-forming material adapted for optically forming a pattern, characterized by comprising a photocatalyst-containing layer provided on a substrate, and the photocatalyst-containing layer contains polysiloxane having a fluoroalkyl group.

The fluoroalkyl group comprised in the pattern-forming material contains a sulfonamide group.

Further, the pattern-forming material is an original plate



for a printing plate.

The present invention also provide a method for pattern formation adapted for optically forming a pattern, characterized in that a photocatalyst provided on a substrate and a pattern-forming material containing polysiloxane having a fluoroalkyl group are pattern-exposed to vary wettability of a surface of the pattern-forming material through photocatalytic action.

[0008]

[Preferred embodiment of the Invention]

The present invention relates to a pattern-forming material wherein a pattern is formed by utilizing the action of a photocatalyst that, upon light irradiation, creates a chemical change of materials present around it and thereby forming a pattern in the light-irradiated area. According to the present invention, the pattern, when used in printing of designs, images, letters and the like, refers to areas that, upon transfer of the printing ink, receive or repel the ink.

[0009]

The mechanism of action of the photocatalyst typified by titanium oxide according to the present invention has not been fully elucidated yet. However, it is considered that carriers produced by light irradiation influence the chemical structure of the organic material through a direct reaction with a

neighboring compound, or otherwise by active oxygen species produced in the presence of oxygen and water.

[0010]

Proposals utilizing the photocatalytic action include one wherein oil stains are decomposed by light irradiation to hydrophilify the oil stains, enabling the oil stains to be washed away by water, one wherein a hydrophilic film is formed on the surface of glass or the like to impart antifogging properties, and one wherein a photocatalyst-containing layer is formed on the surface of tiles or the like to form the so-called antimicrobial tiles or the like that can reduce the number of bacteria floating in air.

[0011]

Enhancement in receptivity of pattern areas to printing inks, toners or the like, by utilizing a photocatalytic action such as decomposition of the organic material to vary the wettability of pattern-formed area and the pattern-unformed substrate area has realized the pattern-forming material according to the present invention.

[0012]

Photocatalysts usable in the pattern-forming material according to the present invention include metal oxides known as photoconductors, such as titanium oxide ( $\text{TiO}_2$ ), zinc oxide ( $\text{ZnO}$ ), tin oxide ( $\text{SnO}_2$ ), strontium titanium oxide

( $\text{SrTiO}_3$ ), tungsten oxide ( $\text{WO}_3$ ), bismuth oxide ( $\text{Bi}_2\text{O}_3$ ), and iron oxide ( $\text{Fe}_2\text{O}_3$ ). Among them, titanium oxide is particularly preferred because it has high band gap energy and is chemically stable, nontoxic, and easily available.

[0013]

Titanium oxide may be in anatase form or rutile form with anatase form of titanium oxide being preferred.

Examples of anatase form of titanium oxide usable herein include ammonia peptization type titania sols (A-6, average crystal diameter 8 nm, manufactured by TAKI CHEMICAL CO., LTD.; STS-11, average crystal diameter 17 nm, manufactured by Ishihara Sangyo Kaisha Ltd.) and nitric acid peptization type titania sols (TA-15, average crystal diameter 12 nm, manufactured by Nissan Chemical Industries Ltd.).

[0014]

The photocatalyst-containing layer according to the present invention may be formed by dispersing a photocatalyst in a binder. The photocatalyst has a fear of decomposing the binder as well upon photoexcitation. Therefore, the binder preferably has a component high has high binding energy as a main component thereof. Further, when use of the pattern-forming material as printing plates is taken into consideration, plate wear and abrasion resistance are also

required of the photocatalyst-containing layer.

[0015]

Siloxane having high binding energy which can express strong strength by cross-linking through a reaction such as sol-gel reaction is preferable as a binder dispersing the photocatalyst.

[0016]

Siloxane may be a hydrolysis condensate or a cohydrolysis condensate of at least one member selected from silicon compounds represented by general formula  $Y_nSiX_{4-n}$  wherein  $n$  is 1 to 3;  $Y$  represents an alkyl, fluoroalkyl, vinyl, amino, or epoxy group; and  $X$  represents a halogen or a methoxyl, ethoxyl, or acetyl group.

[0017]

Specific examples thereof include methyltrichlorosilane, methyltribromosilane, methyltrimethoxysilane, methyltriethoxysilane, methyltriisopropoxysilane, methyl-tri-t-butoxysilane; ethyltrichlorosilane, ethyltribromosilane, ethyltrimethoxysilane, ethyltriethoxysilane, ethylsopropoxysilane, ethyl-tri-t-butoxysilane; n-propyltrichlorosilane, n-propyltribromosilane, n-propyltrimethoxysilane, n-propyltriethoxysilane, n-propyltriisopropoxysilane, n-propyl-tri-t-butoxysilane; n-hexyltrichlorosilane,

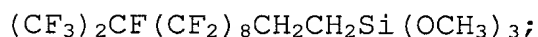
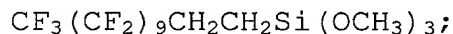
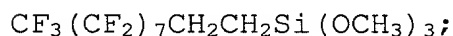
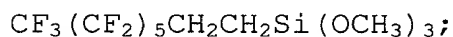
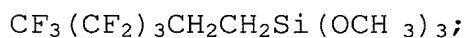
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n-hexyltriethoxysilane,	n-hexyltriisopropoxysilane,
n-hexyl-tri-t-butoxysilane;	n-decyltrichlorosilane,
n-decyltribromosilane,	n-decyltrimethoxysilane,
n-decyltriethoxysilane,	n-decyltriisopropoxysilane,
n-decyl-tri-t-butoxysilane;	n-octadecyltrichlorosilane,
n-octadecyltribromosilane,	n-octadecyltrimethoxysilane,
n-octadecyltriethoxysilane,	n-octadecyltriisopropoxysilane,
n-octadecyl-tri-t-butoxysilane;	phenyltrichlorosilane,
phenytribromosilane,	phenyltrimethoxysilane,
phenyltriethoxysilane,	phenyltriisopropoxysilane,
phenyl-tri-t-butoxysilane;	tetrachlorosilane,
tetrabromosilane,	tetramethoxysilane,
tetraethoxysilane,	
tetrabutoxysilane,	dimethoxydiethoxysilane;
dimethyldichlorosilane,	dimethyldibromosilane,
dimethyldimethoxysilane,	dimethyldiethoxysilane;
diphenyldichlorosilane,	diphenyldibromosilane,
diphenyldimethoxysilane,	diphenyldiethoxysilane;
phenylmethyldichlorosilane,	phenylmethyldibromosilane,
phenylmethyldimethoxysilane,	phenylmethyldiethoxysilane;
trichlorohydrosilane,	tribromohydrosilane,
trimethoxyhydrosilane,	triethoxyhydrosilane,
triisopropoxyhydrosilane,	tri-t-butoxyhydrosilane;
vinyltrichlorosilane,	vinyltribromosilane,

vinyltrimethoxysilane, vinyltriethoxysilane,  
 vinyltriisopropoxysilane, vinyl-tri-t-butoxysilane;  
 trifluoropropyltrichlorosilane,  
 trifluoropropyltribromosilane,  
 trifluoropropyltrimethoxysilane,  
 trifluoropropyltriethoxysilane,  
 trifluoropropyltriisopropoxysilane,  
 trifluoropropyl-tri-t-butoxysilane;  $\gamma$ -glycidoxypropylmethyl  
 dimethoxysilane,  
 $\gamma$ -glycidoxypropylmethyldiethoxysilane,  $\gamma$ -glycidoxypropyltrim  
 ethoxysilane,  $\gamma$ -glycidoxypropyltriethoxysilane,  
 $\gamma$ -glycidoxypropyltriisopropoxysilane,  
 $\gamma$ -glycidoxypropyl-ti-t-butoxysilane;  
 $\gamma$ -methacryloxypropylmethyldimethoxysilane,  
 $\gamma$ -methacryloxypropylmethyldiethoxysilane,  
 $\gamma$ -methacryloxypropyltrimethoxysilane,  
 $\gamma$ -methacryloxypropyltriethoxysilane,  
 $\gamma$ -methacryloxypropyltriisopropoxysilane,  
 $\gamma$ -methacryloxypropyl-tri-t-butoxysilane;  
 $\gamma$ -aminopropylmethyldimethoxysilane,  
 $\gamma$ -aminopropylmethyldiethoxysilane,  
 $\gamma$ -aminopropyltrimethoxysilane,  $\gamma$ -aminopropyltriethoxysilane,  
 $\gamma$ -aminopropyltiisopropoxysilane,  
 $\gamma$ -aminopropyl-tri-t-butoxysilane;

$\gamma$ -mercaptopropylmethyldimethoxysilane,  
 $\gamma$ -mercaptopropylmethyldiethoxysilane,  
 $\gamma$ -mercaptopropyltrimethoxysilane,  
 $\gamma$ -mercaptopropyltriethoxysilane,  
 $\gamma$ -mercaptopropyltriisopropoxysilane,  
 $\gamma$ -mercaptopropyl-tri-t-butoxysilane;  
 $\beta$ -(3,4epoxycyclohexyl)ethyltrimethoxysilane,  
 $\beta$ -(3,4-epoxycyclohexyl)ethyltriethoxysilane; and partial hydrolyzates thereof; and mixtures thereof.

[0018]

The pattern-forming material of the present invention comprises a fluoroalkyl group. Specifically, the silicone is formed from at least one member selected from hydrolysis condensates and cohydrolysis condensates of the following fluoroalkylsilanes. Compounds containing fluoroalkyl groups include the following compounds. Compounds generally known as fluorosilane coupling agents may also be used.



$\text{CF}_3(\text{C}_6\text{H}_4)\text{C}_2\text{H}_4\text{Si}(\text{OCH}_3)_3;$   
 $\text{CF}_3(\text{CF}_2)_3(\text{C}_6\text{H}_4)\text{C}_2\text{H}_4\text{Si}(\text{OCH}_3)_3;$   
 $\text{CF}_3(\text{CF}_2)_5(\text{C}_6\text{H}_4)\text{C}_2\text{H}_4\text{Si}(\text{OCH}_3)_3;$   
 $\text{CF}_3(\text{CF}_2)_7(\text{C}_6\text{H}_4)\text{C}_2\text{H}_4\text{Si}(\text{OCH}_3)_3;$   
 $\text{CF}_3(\text{CF}_2)_3\text{CH}_2\text{CH}_2\text{SiCH}_3(\text{OCH}_3)_2;$   
 $\text{CF}_3(\text{CF}_2)_5\text{CH}_2\text{CH}_2\text{SiCH}_3(\text{OCH}_3)_2;$   
 $\text{CF}_3(\text{CF}_2)_7\text{CH}_2\text{CH}_2\text{SiCH}_3(\text{OCH}_3)_2;$   
 $\text{CF}_3(\text{CF}_2)_9\text{CH}_2\text{CH}_2\text{SiCH}_3(\text{OCH}_3)_2;$   
 $(\text{CF}_3)_2\text{CF}(\text{CF}_2)_4\text{CH}_2\text{CH}_2\text{SiCH}_3(\text{OCH}_3)_2;$   
 $(\text{CF}_3)_2\text{CF}(\text{CF}_2)_6\text{CH}_2\text{CH}_2\text{SiCH}_3(\text{OCH}_3)_2;$   
 $(\text{CF}_3)_2\text{CF}(\text{CF}_2)_8\text{CH}_2\text{CH}_2\text{SiCH}_3(\text{OCH}_3)_2;$   
 $\text{CF}_3(\text{C}_6\text{H}_4)\text{C}_2\text{H}_4\text{SiCH}_3(\text{OCH}_3)_2;$   
 $\text{CF}_3(\text{CF}_2)_3(\text{C}_6\text{H}_4)\text{C}_2\text{H}_4\text{SiCH}_3(\text{OCH}_3)_2;$   
 $\text{CF}_3(\text{CF}_2)_5(\text{C}_6\text{H}_4)\text{C}_2\text{H}_4\text{SiCH}_3(\text{OCH}_3)_2;$   
 $\text{CF}_3(\text{CF}_2)_7(\text{C}_6\text{H}_4)\text{C}_2\text{H}_4\text{SiCH}_3(\text{OCH}_3)_2;$   
 $\text{CF}_3(\text{CF}_2)_3\text{CH}_2\text{CH}_2\text{Si}(\text{OCH}_2\text{CH}_3)_3;$   
 $\text{CF}_3(\text{CF}_2)_5\text{CH}_2\text{CH}_2\text{Si}(\text{OCH}_2\text{CH}_3)_3;$   
 $\text{CF}_3(\text{CF}_2)_7\text{CH}_2\text{CH}_2\text{Si}(\text{OCH}_2\text{CH}_3)_3;$   
 $\text{CF}_3(\text{CF}_2)_9\text{CH}_2\text{CH}_2\text{Si}(\text{OCH}_2\text{CH}_3)_3;$   
 $\text{CF}_3(\text{CF}_2)_7\text{SO}_2\text{N}(\text{C}_2\text{H}_5)\text{C}_2\text{H}_4\text{CH}_2\text{Si}(\text{OCH}_3)_3.$

These fluoroalkylsilanes can drastically improve oil repellency and the pattern-forming material is enabled to express a function to prevent ink adhesion.

[0019]



The photocatalyst-containing layer may contain a surfactant. Specific examples of organic materials usable herein include hydrocarbon nonionic surfactants, such as NIKKOL BL, BC, BO, and BB series manufactured by Nihon Surfactant Kogyo K.K.; and fluoro or silicone nonionic surfactants, such as ZONYL FSN and FSO, manufactured by E.I. du Pont de Nemours & Co., SurfluonS-141 and 145 manufactured by Asahi Glass Co., Ltd., Megafac F-141 and 144 manufactured by Dainippon Ink and Chemicals, Inc., Ftergent F-200 and F-251, manufactured by Neos Co., Ltd.; Unidyne DS-401 and 402 manufactured by Daikin Industries, Ltd., and Fluorad FC-170 and 176 manufactured by Sumitomo 3M Ltd. Cationic, anionic, and amphoteric surfactants may also be used.

[0020]

Examples of organic materials other than surfactants usable herein include oligomers and polymers, such as polyvinyl alcohol, unsaturated polyesters, acrylic resins, polyethylene, diallylphthalate, ethylene propylene diene monomer, epoxy resin, phenolic resin, polyurethane, melamine resin, polycarbonate, polyvinyl chloride, polyamide, polyimide, styrene butadiene rubber, chloroprene rubber, polypropylene, polybutylene, polystyrene, polyvinyl acetate, nylon, polyester, polybutadiene, polybenzimidazole, polyacrylonitrile, epichlorohydrin, polysulfide, and polyisoprene.

[0021]

The content of photocatalyst contained in the photocatalyst-containing layer is preferably 5 to 60% by weight, more preferably 20 to 40% by weight. The photocatalyst and the binder may be dispersed in a solvent to prepare a coating liquid followed by coating of the liquid. Solvents usable herein include alcoholic organic solvents, such as ethanol and isopropanol.

[0022]

A photocatalyst having a smaller particle diameter can more effectively causes the photocatalytic reaction and hence is preferred. Use of a photocatalyst having an average particle diameter of preferably not more than 50 nm, more preferably not more than 20 nm, is preferred. Further, the photocatalyst having a smaller particle diameter can advantageously provide a photocatalyst-containing layer having smaller surface roughness. A surface roughness of the photocatalyst-containing layer exceeding 10 nm is unfavorable because concavity and convexity in the surface makes the wettability to water, a solution or an ink poor and thereby appearance of wettability becomes unsatisfactory.

[0023]

The excitation wavelength of the anatase form of titania is not more than 380 nm. Therefore, the excitation of this type of photocatalysts should be carried out using ultraviolet light.

Ultraviolet light sources usable herein include mercury lamps, metal halide lamps, xenon lamps, excimer lamps, excimer layer, YAG laser, and other ultraviolet light sources. The wettability of the film surface may be varied by varying the ultraviolet light intensity, exposure and the like.

[0024]

The photocatalyst-containing coating liquid may be coated onto the substrate by spray coating, dip coating, roll coating, bead coating or the like. When an ultraviolet curable component is contained as the binder, curing by ultraviolet irradiation results in the formation of a photocatalyst-containing composition layer on the substrate.

[0025]

As shown in FIG. 1A, the pattern-forming material of the present invention comprises: a photocatalyst 2, siloxane 3, and a photocatalyst-containing layer 5 containing a fluoroalkyl group 4 which is a material of which wettability is varied through photocatalytic action upon light exposure, provided on a substrate 1. The fluoroalkyl group 4 exhibits strong oil repellency and forms a low-surface energy layer.

[0026]

By exposing light of a predetermined pattern, as shown in FIG. 1B, the fluoroalkyl group 4 is dispersed through photocatalytic action of the photocatalyst 2 and areas the

surface of which is varied according to the exposed light 6 are formed. Pattern information is thus recorded.

[0027]

According to the pattern-forming material of the present invention, the surface free energy is varied through the action of the catalyst in the composition, and the wettability-varied areas have varied receptivity to printing ink. Therefore, the pattern-forming material may be used as printing plates. Use of the structure for pattern formation according to the present invention as an original plate for a printing plate can eliminate the need to provide the step of wet development and the like and can offer a feature that the preparation of a printing plate is completed simultaneously with exposure. The pattern formation of the pattern-forming material according to the present invention may be performed by exposure through a process film or the like or by direct pattern formation using a laser or the like.

[0028]

In preparing an original plate for a printing plate, substrates usable herein include those commonly used in offset printing plates, such as aluminum. Alternatively, a pattern may be formed by coating a photocatalyst-containing composition layer onto a screen of a woven fabric or a nonwoven fabric and exposing the photocatalyst-containing layer. When the

substrate is constituted by a material, such as a plastic, that has a fear of being deteriorated by the photo-oxidation activity of the photocatalyst, a silicone, a fluoro resin or the like may be previously coated onto the substrate to form a protective layer. A photochromic material such as spiropyrene may be incorporated into the composition to form a visualized pattern which is formed by the variation caused in wettability. Further, a desired metal pattern may be formed by applying light to the pattern-forming material according to the present invention to form a predetermined pattern of hydrophilic areas, treating the hydrophilic areas with a catalyst for chemical plating and immersing the pretreated material in a chemical plating catalyst to form a desired metal pattern. According to this method, a metal pattern can be formed without the formation of a resist pattern, making it possible to produce printed boards, electronic circuit elements and the like.

[0029]

By utilizing strong water repellency and oil repellency of the fluorine compound, the pattern-forming material of the present invention can be used to manufacture product such as a high quality color filter which requires highly-precise pattern formation. When a resin-containing composition for forming color filter is formed on a photocatalyst-containing layer after pattern exposure by a method such as coating, printing and ink

jet method, a resin-containing composition can be applied only to an exposed part. Accordingly, a total amount of the resin-containing composition used can be decreased. Further, a high-resolution color filter can be obtained without performing an extra process such as a development process using a resin composition as a photosensitive composition.

[0030]

[EXAMPLES]

The following examples further illustrate the present invention.

Example 1

Mixed together were 3 g of Glasca HPC7002 (Japan Synthetic Rubber Co., Ltd.), a silica sol, and 1 g of HPC402H (Japan Synthetic Rubber Co., Ltd.), an alkylalkoxysilane. The mixture was stirred for 5 min. The resultant solution was spin coated on a glass substrate having an area of 7.5 cm<sup>2</sup>. Thus, a 2  $\mu$ m-thick sodium ion block layer was formed.

[0031]

Next, 3 g of isopropyl alcohol, 0.75 g of a silica sol (Glasca HPC7002, manufactured by Japan Synthetic Rubber Co., Ltd.), 0.25 g of an alkylalkoxysilane (Glasca HPC402H, manufactured by Japan Synthetic Rubber Co., Ltd.), and 0.15 g of a fluoroalkylsilane (MF-160E manufactured by Tohchem Products Corporation: a 50 wt % isopropyl ether solution of

N-[3-(trimethoxysilyl)propyl]-N-ethylperfluorooctanesulfonamide) were mixed together. The resultant dispersion was stirred for 20 min while maintaining the temperature at 100°C. Thereafter, 2 g of titanium oxide (titanium oxide coating liquid ST-K01, solid content 10% by weight, manufactured by Ishihara Sangyo Kaisha Ltd.) was added thereto, followed by stirring for additional 30 min.

[0032]

The resultant dispersion was spin coated on the substrate with a sodium block layer formed thereon. The assembly was dried at a temperature of 150°C for 10 min, permitting hydrolysis and polycondensation to proceed. Thus, a 3  $\mu\text{m}$ -thick photocatalyst-containing layer with a photocatalyst being strongly fixed through an organopolysiloxane was formed. The average roughness of the surface of the photocatalyst-containing layer was measured by the tracer method and found to be  $R_a=2$  nm. Further, the photocatalyst-containing layer was irradiated with ultraviolet light at an intensity of 70 mW/Cm<sup>2</sup> for 2 min using a high pressure mercury lamp through an adhered lattice-like mask. In this case, the contact angle of the photocatalyst-containing layer with water and n-octane was measured with a contact angle goniometer (Model CA-Z, manufactured by Kyowa Interface Science Co., Ltd.). The results are shown in Table 1.

[0033]

#### Example 2

A sodium ion block layer was prepared in the same manner as in Example 1. Next, 3 g of isopropyl alcohol, 0.4 g of an organosilane (TSL8113, manufactured by Toshiba Silicone Co., Ltd.), 0.15 g of a fluoroalkylsilane (MF-160E, manufactured by Tohchem Products Corporation: a 50 wt % isopropyl ether solution of N-[3-(trimethoxysilyl)propyl]-N-ethylperfluorooctanesulfonamide), and 2 g of titanium oxide (titanium oxide coating liquid ST-K01, solid content 10% by weight, manufactured by Ishihara Sangyo Kaisha Ltd.) were mixed together. The resultant dispersion was stirred for 20 min while maintaining the temperature at 100°C. The resultant dispersion was spin coated on the substrate with a sodium block layer formed thereon. The assembly was dried at a temperature of 150°C for 10 min, permitting hydrolysis and polycondensation to proceed. Thus, a 3  $\mu$ m-thick photocatalyst-containing layer with a photocatalyst being strongly fixed in an organopolysiloxane was formed. The average roughness of the surface of the photocatalyst-containing layer was measured by the tracer method in the same as Example 1 and found to be  $R_a=2$  nm. Further, the photocatalyst-containing layer was irradiated with ultraviolet light at an intensity of 70 mW/cm<sup>2</sup> for 2 min using a high pressure mercury lamp through



an adhered lattice-like mask. In this case, the contact angle of the photocatalyst-containing layer with water and n-octane was measured with a contact angle goniometer (Model CA-Z, manufactured by Kyowa Interface Science Co., Ltd.). The results are shown in Table 1.

[0034]

### Example 3

A sodium ion block layer was prepared in the same manner as in Example 1. Next, 3 g of isopropyl alcohol, 2.2 g of an organosilane (TSL8113, manufactured by Toshiba Silicone Co., Ltd.), 0.15 g of a fluoroalkylsilane (MF-160E, manufactured by Tohchem Products Corporation: a 50 wt % isopropyl ether solution of

N-[3-(trimethoxysilyl)propyl]-N-ethylperfluorooctanesulfonamide), and 0.2 g of titanium oxide powder (ST-01, average particle diameter 7 nm, manufactured by Ishihara Sangyo Kaisha Ltd.) were mixed together. The resultant dispersion was stirred for 20 min while maintaining the temperature at 100°C. The resultant dispersion was spin coated on the substrate with a sodium ion block layer formed thereon. The assembly was dried at a temperature of 150°C for 10 min, permitting hydrolysis and polycondensation to proceed. Thus, a 3µm-thick photocatalyst-containing layer with a photocatalyst being strongly fixed in an organosiloxane was formed. The average

roughness of the surface of the photocatalyst-containing layer was measured by the tracer method in the same manner as Example 1 and found to be  $R_a=2\text{ nm}$ . Further, the photocatalyst-containing layer was irradiated with ultraviolet light at an intensity of  $70\text{ mW/cm}^2$  for 5 min using a high pressure mercury lamp through an adhered lattice-like mask. In this case, the contact angle of the photocatalyst-containing layer with water and n-octane was measured with a contact angle goniometer (Model CA-Z, manufactured by Kyowa Interface Science Co., Ltd.). The results are shown in Table 1.

[0036]

#### Example 5

A sodium ion block layer was prepared in the same manner as in Example 1. Next, 3 g of isopropyl alcohol, 0.4 g of an organosilane (TSL8113, manufactured by Toshiba Silicone Co., Ltd.), 0.75 g of a fluoroalkylsilane (MF-160E, manufactured by Tohchem Products Corporation: a 50 wt % isopropyl ether solution of

N-[3-(trimethoxysilyl)propyl]-N-ethylperfluorooctanesulfonamide), and 2 g of titanium oxide (titanium oxide coating liquid ST-K01, solid content 10% by weight, manufactured by Ishihara Sangyo Kaisha Ltd.) were mixed together. The resultant dispersion was stirred for 60 min while maintaining the temperature at  $100^\circ\text{C}$ . The resultant dispersion was spin coated

on the substrate with a sodium ion block layer formed thereon. The assembly was dried at a temperature of 150°C for 10 min, permitting hydrolysis and polycondensation to proceed. Thus, a 3 $\mu$ m-thick photocatalyst-containing layer with a photocatalyst being strongly fixed in an organosiloxane was formed. Further, the photocatalyst-containing layer was irradiated with ultraviolet light at an intensity of 70 mW/cm<sup>2</sup> for 10 min using a high pressure mercury lamp through an adhered lattice-like mask. In this case, the contact angle of the photocatalyst-containing layer with water and n-octane was measured with a contact angle goniometer (Model CA-Z, manufactured by Kyowa Interface Science Co., Ltd.). The results are shown in Table 1.

[0037]

#### Example 6

A photocatalyst-containing layer was formed in the same manner as in Example 2. The photocatalyst-containing layer was irradiated with ultraviolet light at an intensity of 70 mW/cm<sup>2</sup> for 2 min using a high pressure mercury lamp through a mask having a pitch of 100  $\mu$ m. A photosensitive resin composition for color pixels of a color filter was dropped. As a result, the composition could wet and spread on exposed areas to form pixels.

[0038]

#### Comparative Example 1

A commercially available original plate for offset printing was evaluated for properties using a thermal plate Pearl dry (manufactured by Presstek) in the same manner as in Example 1. The results are summarized in Table 1.

[0039]

#### Comparative Example 2

A waterless offset plate HGII (manufactured by Toray Industries, Inc.), a commercially available original plate for offset printing, was evaluated for properties in the same manner as in Example 1. The results are summarized in Table 1.

[0040]

#### Comparative Example 3

A photocatalyst-containing layer was formed in the same manner as in Example 2, except that the fluoroalkylsilane was not used. The photocatalyst-containing layer was evaluated for properties in the same manner as in Example 2. The results are summarized in Table 1.

[0041]

#### Comparative Example 4

A sodium ion block layer was prepared in the same manner as in Example 1. Next, 3 g of isopropyl alcohol, 2.2 g of an organosilane (TSL8113, manufactured by Toshiba Silicone Co., Ltd.), 0.15 g of a fluoroalkylsilane (MF-160E, manufactured by Tohchem Products Corporation: a 50 wt % isopropyl ether solution

of

N-[3-(trimethoxysilyl)propyl]-N-ethylperfluorooctanesulfonamide), and 0.2 g of titanium oxide powder (ST-41, average particle diameter 50 nm, manufactured by Ishihara Sangyo Kaisha Ltd.) were mixed together. The resultant dispersion was stirred for 20 min while maintaining the temperature at 100°C. The resultant dispersion was spin coated on the substrate with a sodium ion block layer formed thereon. The assembly was dried at a temperature of 150°C for 10 min, permitting hydrolysis and polycondensation to proceed. Thus, a 3µm-thick photocatalyst-containing layer with a photocatalyst being strongly fixed in an organosiloxane was formed. The average roughness of the surface of the photocatalyst-containing layer was measured by the tracer method in the same manner as in Example 1 and found to be Ra=30 nm. Further, the photocatalyst-containing layer was irradiated with ultraviolet light at an intensity of 70 mW/cm<sup>2</sup> for 5 min using a high pressure mercury lamp through an adhered lattice-like mask. In this case, the contact angle of the photocatalyst-containing layer with water and n-octane was measured with a contact angle goniometer (Model CA-Z, manufactured by Kyowa Interface Science Co., Ltd.). The results are summarized in Table 1.

[0042]

Table 1

	Pixel Part		Non-Pixel Part	
	Water	n-Octane	Water	n-Octane
Example 1	Below 5°	Below 5°	113°	16°
Example 2	Below 5°	Below 5°	107°	47°
Example 3	Below 5°	Below 5°	105°	40°
Example 4	Below 5°	Below 5°	100°	30°
Example 5	Below 5°	Below 5°	151°	77°
Comparative Example 1	84°	Below 5°	105°	11°
Comparative Example 2	104°	5°	116°	13°
Comparative Example 3	Below 5°	Below 5°	86°	10°
Comparative Example 4	10°	10°	105°	26°

[0043]

[Effects of the Invention]

The pattern-forming material of the present invention comprises a photocatalyst-containing composition layer provided on a substrate, wherein the photocatalyst-containing composition layer contains polysiloxane having a fluoroalkyl group. Accordingly, wettability difference to water or to a lipophilic material between a light exposed part and unexposed part is large so that the pattern-forming material of the present invention can be applied for various purposes such as an original plate for a printing plate.

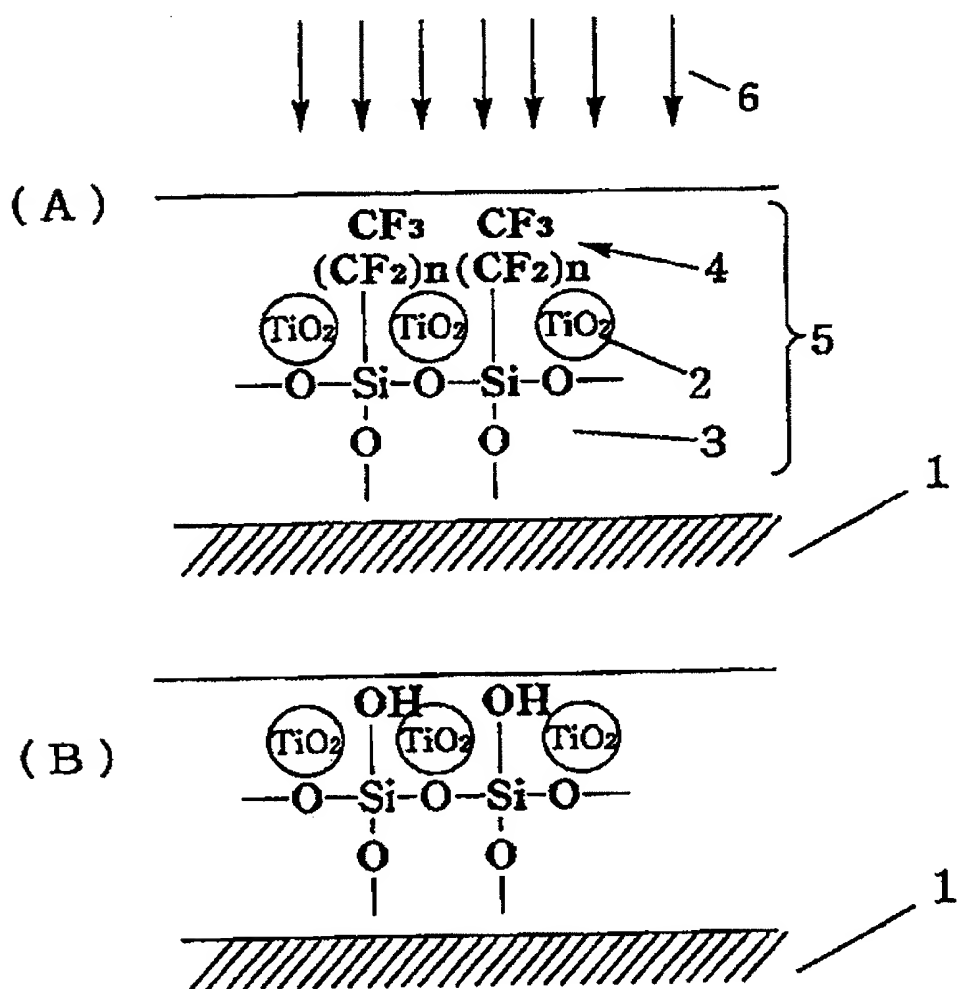
[Brief Description of the Drawing]

[FIG. 1] A diagram showing one embodiment of the present invention.

[Description of the reference number]

- 1 substrate
- 2 photocatalyst
- 3 siloxane
- 4 fluoroalkyl group
- 5 photocatalyst-containing layer
- 6 exposure

[FIG. 1]





[Document Title]

ABSTRACT

[Abstract]

[Object] A pattern-forming material using a photocatalyst is provided.

[Means of solution] A pattern-forming material comprising a photocatalyst-containing layer provided on a substrate, wherein the photocatalyst-containing layer comprises polysiloxane having a fluoroalkyl group, and wherein a pattern is recorded by varying the wettability upon light exposure.

[Elected Drawing] FIG. 1